WISCONSIN ENDANGERED RESOURCES REPORT 27

WISCONSIN PEREGRINE FALCON RECOVERY PLAN

by Charlene M. Gieck

SUMMARY

This plan delineates and schedules actions required to restore a viable breeding population of the peregrine falcon (Falco peregrinus) in Wisconsin. The goal is to have 20 breeding pairs in Wisconsin. The interim objective is to have 10 breeding pairs by the year 2000. The goals will be re-evaluated at that time. Success will depend upon available habitat and release success in Wisconsin and other midwestern states.

Planned recovery activities include:

1. Inventory, assess, and protect nesting habitat. Sites formerly occupied and potential nesting sites will be located and assessed. Site-specific management plans will be developed. Sites on private and public lands will be protected by easements or land-use agreements. Predator control techniques will be used to protect released birds.

2. Establish reintroduction program. Three areas--Mississippi River, downtown Milwaukee, and Devil's Lake State Park--will be the initial (1987) sites for releasing birds. The releases will involve 3 types: tower or hacking release, building release, and foster parent release. Future release sites will be chosen from the inventory of suitable habitat.

   Peregrines will be acquired through the Minnesota Project from private breeders. Construction materials and some site attendant time will be donated. Birds will be monitored with radio-telemetry equipment if funding allows. Release sites will be surveyed annually for breeding activities.

3. Provide peregrine protection. Law enforcement personnel will be kept informed of nesting and release activities. Supplements will be developed for Hunter and Falconry Training Programs. Monitoring for environmental contaminants will be conducted around the nesting and feeding areas.

4. Implement coordination, information, and education. Close coordination will be maintained among five midwestern states--Minnesota, Wisconsin, Michigan, Illinois, and Iowa. The public will be provided with updates on the project and general information on the peregrine falcon.

Evaluation of the peregrine falcon's status will be ongoing.

BUREAU OF ENDANGERED RESOURCES
Wisconsin Department of Natural Resources
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(AD-75)

CORRESPONDENCE/MEMORANDUM

STATE OF WISCONSIN

Date: January 27, 1987

File Ref: 1720

To: James R. Huntoon - AD/5
Administrator, Resources Management

From: Ronald F. Nicotera
Director, Bureau of Endangered Resources

Subject: Wisconsin Peregrine Falcon Recovery Plan

Please review and approve the attached Recovery Plan. The Executive Summary briefly explains the plan.

Comments from experts in the DNR, the University System, and the private sector have been incorporated.

This plan is a dynamic document which will be revised as necessary to incorporate new techniques, facts, and goal changes.

Copies of the plan will be disseminated to the persons providing direct comments and any others requesting copies.

If you have any questions, please do not hesitate to contact me.

APPROVED: James R. Huntoon 1/28/87

James R. Huntoon

Date

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Executive Summary

The Wisconsin Peregrine Falcon Recovery Plan delineates and schedules actions required for restoration of a viable breeding population of the peregrine falcon (Falco peregrinus) in Wisconsin. The goal is to have 20 breeding pairs in Wisconsin. The interim objective is to have 50% of this level or 10 breeding pairs by the year 2000. The goals will be re-evaluated at that time. Success will depend upon available habitat and release success (both in Wisconsin and other Midwest States).

The Wisconsin Recovery Plan was developed in general conformity with, and in several sections taken verbatim from, the U.S. Fish and Wildlife Service (USFWS) Eastern Peregrine Falcon Recovery Plan (Bollengier 1979) and "A Proposal for the Restoration of the Peregrine Falcon to the Upper Mississippi River and other Midwestern Areas" (Redig et al, 1981). Although written to supplement the Federal Plan, the Wisconsin Plan represents the opinion of the Wisconsin Department of Natural Resources (WDNR) and has not received official approval from USFWS, the Eastern Peregrine Falcon Recovery Team, nor the Cornell University Laboratory of Ornithology.

The plan is divided into two major segments. Part I--Recovery Action Plan, details the efforts required for recovery; Part II--Background, details the life history and status of the peregrine falcon.

Recovery Action Plan activities are grouped under 4 general categories:

1. Inventory, assess, and protect nesting habitat. Sites formerly occupied and potential nesting sites will be located and assessed. Site-specific management plans will be developed. Sites on private and public lands will be protected by easements or land use agreements. Predator control techniques will be used to protect released birds.

2. Establish reintroduction program. Three areas--Mississippi River, downtown Milwaukee, and Devil's Lake State Park--will be the initial (1987) sites for releasing birds. The releases will involve 3 types: tower or hacking release, building release, and foster parent release. Future release sites will be chosen from the inventory of suitable habitat.

   Peregrines will be acquired through the Minnesota Project from private breeders. Construction materials and some site attendant time will be donated. Birds will be monitored with radio-telemetry equipment if funding allows. Release sites will be surveyed annually for breeding activities.

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4. Implement coordination, information, and education. Close coordination will be maintained among five Midwest states--Minnesota, Wisconsin, Michigan, Illinois, and Iowa. The public will be provided with updates on the project and general information on the peregrine falcon.

The plan has been reviewed by Bureau of Endangered Resources (BER) staff, Wildlife Management staff, U.S. Forest Service, U.S. Fish and Wildlife Service, outside experts, and the Resource Management Administrator. Comments were reviewed and incorporated in many cases.

Evaluation of the peregrine falcon's status will be ongoing.

Preface

This Recovery Plan was prepared by Charlene M. Gieck, Natural Resources Specialist, WDNR-Bureau of Endangered Resources. It was reviewed by the Department of Natural Resources, the U.S. Forest Service, U.S. Fish and Wildlife Service, and experts from Wisconsin and other states.

The plan will be revised as necessary to incorporate new techniques and facts. Goals and objectives will be modified as tasks are completed or as priorities and budgetary constraints require.

Additional copies may be obtained from:

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Acknowledgements

Reviews and comments on preliminary drafts were received from personnel in the WDNR Bureaus of:

Endangered Resources
Wildlife Management
Research
Information and Education
Law Enforcement

Comments were provided by the following experts:

John Popowski - USFWS, Minnesota
William M. Byers, Jr. - Chequamegon National Forest
Don G. Follen, Sr. - Wisconsin Foundation for Wildlife Research
Brent M. Haglund - The Nature Conservancy
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Eric G. Ratering - Private Falconer
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Funding for this project was provided in part through the Federal Aid in Wildlife Restoration Act.

Part I. RECOVERY ACTION PLAN

A. Recovery Goal

The ultimate goal of this Recovery Plan is to restore a viable wild population of peregrine falcons in Wisconsin. An interim objective is to attain a self-sustaining, wild nesting population at a level of 50-percent of the estimated 20 breeding pairs known to have occurred in the early 1950's. This objective can be accomplished by implementing the following strategies: inventory and protect nesting habitat, restore the peregrine population through introduction of captive-produced birds, provide protection, and develop information and education programs. Captive-produced birds will be released at a rate of 10-20 birds per year until 1995 at which time the released and wild-produced birds should equal 10 breeding pairs. See Life Table, Figure 1. Some breeding birds may repopulate Wisconsin from Minnesota or Michigan releases.

B. Plan Outline and Justification

1. Inventory, assess, and protect nesting habitat.

An inventory of nest sites of the U.S. east of Mississippi River was conducted by Hickey in the early forties (1942), repeated in 1964 by Berger, Sindelar and Gamble (1969), and repeated in part by Cornell University representatives during the spring and summer of 1975. It is believed that approximately 20 suitable sites are left in Wisconsin (Natural Heritage Inventory Files). These are mapped in confidential DNR files. The proposed 1987 survey would include the Mississippi River between Prescott and Eastern Dubuque, Illinois, the south central Wisconsin area, Door County and selected cliffs in northern Wisconsin.

1.1 Inventory and assess potential nesting sites.

1.11 Locate and assess sites to determine suitability for falcon occupancy. Assessment criteria and other necessary information on each site are described in Appendix 1 - Eyries Inventory and Site Assessment Form. These sites may be used to determine where population centers could be re-established through releases.

1.12 Annually monitor traditional and potential sites for breeding activity.

1.2 Protect and manage suitable potential nest sites.

1.21 Prepare site-specific management plans. Assure control of habitat through acquisition, easement, lease or cooperative agreement. A sample management plan format is presented in Appendix 2 as a guideline. Management needs vary considerably between

sites and are dependent upon a variety of factors. An important factor to be considered is the protection from predators. Great horned owls can prey heavily upon young birds. Mammals, like raccoons, can prey upon eggs and young.

1.22 Determine land ownership and usage on and around the site. This will be coordinated with The Nature Conservancy's Midwest Regional Registry Program.

2. Establish reintroduction program.

2.1 Select and prepare release sites. The three 1987 release areas will be the Mississippi River, downtown Milwaukee, and Devil's Lake State Park. Future release sites will be chosen from the inventory of suitable habitat.

Mississippi River

Releases at the Minnesota Weaver Dunes site were aborted in 1986 due to aggressive defense behavior by a territorial peregrine falcon occupying a cliff site across the Mississippi River. A new release site along the Mississippi River will be chosen in the southwest corner of Wisconsin or the southeast corner of Minnesota. The survey will document potential release sites up to 20 miles from the river. These sites will be evaluated and one selected. If the preferred site is located in Minnesota, Wisconsin will actively support the project.

Door County is another historical nesting area, but will not be considered as a release site for 1987. Environmental contaminants are being monitored in this area and are not at a level conducive to falcon release.

Milwaukee

Peregrines have adapted to man-made sites in the past and raised young on buildings in large cities. The close proximity to people in downtown Milwaukee will enable extensive public education also. The building owners will be actively involved in the project.

Devil's Lake State Park

A hybrid peregrine x prairie falcon male (presumed to be an escaped falconry bird) established a territory in the Sauk County bluffs in 1985. A pure peregrine female joined the male in 1986. If they return and nest in 1987, any eggs laid will probably be infertile. Young peregrines will be substituted to keep this pair in the area.

2.2 Acquire peregrines from captivity.

Wisconsin will work closely with Minnesota to coordinate a supply of anatum peregrine falcons from private breeders in the Midwest. Depending on the breeding success, 10-20 birds will be available to Wisconsin for 1987.

2.3 Conduct release of falcons to the wild. Birds will be released from selected sites annually, and it is anticipated that they will return in about 2-3 years to occupy and establish themselves in areas suitable for occupancy within the release regions.

2.31 Use tower and building release techniques.

The hacking technique allows a small number of people to release a large number of falcons each year. In most cases, at least two people will be required at each hacking station for 8-10 weeks to handle 4 or more young falcons.

The hacking process was described by Cade and Temple (1977). Wisconsin's proposed platform hacking program would follow the guidelines supplied by the Minnesota program.

Building releases have been successful in Chicago, Michigan, and Minnesota. Adult birds may return to buildings to nest or will find suitable habitat in nearby areas.

2.311 Construct hacking towers/boxes. Donated materials and labor will be sought to build these structures. Minor alterations may be necessary at the building release site (i.e., covering of vents).

2.312 Secure a peregrine food source.

2.313 Hire or locate volunteer site attendants.

2.314 Introduce young falcons to the wild by the hacking process. (Mississippi River 6-11 birds, Milwaukee 5 birds; more if funding and chick availability permit).

2.3141 Coordinate banding/marking system with other Midwest states release projects to monitor bird movement.

2.3142 Monitor bird behavior after release.

Radio-telemetry or trained observers will be used to monitor the bird's activities. The observations will document movement in the area, prey base use, and mortality.

2.32 Use foster parent release technique. Foster parenting is labor intensive, but because a pair exists in this (Devil's Lake) historic nesting area, supplying them with young may keep the pair in the area.

2.321 Hire or locate volunteer site attendants.

2.322 Monitor the site for the return of the pair and for breeding activity.

2.323 Develop predator control. Protection will be needed against great horned owls and raccoons. Notice will be made to hikers and rock climbers in this area to minimize human disturbance.

2.324 "Release" young peregrines.

2.3241 Any eggs produced by this pair will be removed and substituted with dummy eggs for the normal incubation period. This will maintain the nesting activity without damage to the eggs.

2.3242 Replace eggs with surrogate young at the end of the incubation period. The reaction to young will be monitored, especially since peregrine chicks are so costly.

2.3243 Replace surrogates with 2-4 peregrine chicks.

2.325 Monitor fledging activities.

2.4 Annually survey release sites and surrounding habitat for peregrine occupancy.

3. Provide peregrine protection.

3.1 Continue law enforcement.

The peregrine falcon is listed as an endangered species in Wisconsin (Chapter NR 27 Wis. Adm. Code) and, thereby, is protected by state law (Chap. 29.415, Wis. Stats.) from taking (includes shooting, shooting at, pursuing, hunting, catching or killing).

This protection is in addition to that provided by Federal regulations which prohibits any form of harassment of peregrine falcons.

3.11 Insure that during a hacking release, site attendants contact law enforcement officials and wildlife management staff to discuss possible violations and means of contacting each other.

During the preliminary planning of Wisconsin releases, the USFWS Region 3 Special Agent, the DNR's Bureau of Law Enforcement, District Warden and local Area Wardens will be contacted regarding law enforcement activities required at the hack site.

3.12 Supplement Hunter Education Program and Falconry Apprenticeship Training.

3.2 Monitor environmental contaminants that adversely affect peregrine survival and reproduction.

3.21 When possible initiate prey sampling and analysis program at selected release and breeding locations to determine contaminant levels and their sources. Recovered carcasses and addled eggs will be analyzed.

3.22 Provide and implement recommendations, when possible, to prevent pesticides and contaminants from adversely affecting peregrine falcons.

4. Implement coordination, information and education.

The ultimate success of this program can be insured only through public acceptance and support. Protection of release and nesting sites can probably be achieved by a combination of local publicity and on-site wardens.

4.1 Establish and maintain communication to coordinate and conduct recovery efforts. Ongoing contact will be maintained with Minnesota and other Midwest states.

4.2 Develop and disseminate brochures, posters, press release kits, and audio-visual programs.

4.3 Prepare magazine articles.

C. Recovery Implementation Schedule

Action	Plan No.	Responsibility* Lead	Responsibility* Cooperator	Target Date	Estimated Costs Fiscal Years 87-88	88-89	89-90	90-91	91-92	92-93
A. Survey and Research										
Inventory and assess potential nesting sites	1.1	NHI	BWM	1988	2000	2000	--	--	--	--
Monitor sites for breeding activity	1.12	NHI	BWM	Ongoing	300	300	300	300	300	300
Determine landownership and usage around sites	1.22	NHI	RES	1987	400	--	--	--	--	--
Select and prepare release sites	2.1	BER	BWM	1987	1000	--	--	--	--	--
Annually survey release sites and surrounding habitat	2.4	BER	BWM	ongoing	2000	2000	2000	2000	2000	2000
Monitor environmental contaminants	3.21	BWM	BER	ongoing	600	600	600	600	600	600

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C. Recovery Implementation Schedule

Action	Plan No.	Responsibility* Lead	Cooperator	Target Date	Estimated Costs Fiscal Years 87-88	88-89	89-90	90-91	91-92	92-93
B. Management										
Prepare site-specific management plans	1.21	BER	BWM	1990	500	500	500	500	--	--
Acquire peregrines from captivity	2.2	BER	BWM	1993	40,000(1)	40,000	40,000	40,000	40,000	40,000
Construct hacking towers/boxes	2.311	BER	BWM	1987	(2)	--	--	--	--	--
Secure food source	2.312	BER	BWM	1987	3200(3)	3200	3200	3200	3200	3200
Locate site attendants	2.313 & 2.321	BER	BWM	1993	10,000	10,000	10,000	10,000	10,000	10,000
Coordinate banding/marking system	2.3141	BER	RES	1987	800	--	--	--	--	--
Monitor bird behavior	2.3142	BER	RES	1993	2000	2000	2000	2000	2000	2000
Monitor Devil's Lake pair	2.322	BER	P&R	1987	2000	--	--	--	--	--
Develop predator control	2.323	BER	P&R	1987	1000	--	--	--	--	--
Release young at Devil's Lake	2.324	BER	P&R	1987	2000	--	--	--	--	--

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C. Recovery Implementation Schedule

Action	Plan No.	Responsibility* Lead	Cooperator	Target Date	Estimated Costs Fiscal Years 87-88	88-89	89-90	90-91	91-92	92-93
C. Administration and Public Education										
Provide law enforcement at release sites	3.11	BER	BLE	1993	1000	1000	1000	1000	1000	1000
Supplement Hunter Education and Falconry Programs	3.12	BER	BLE	1989	--	600	600	--	--	--
Provide recommendations regarding contaminants	3.22	BER	BWM	1989	200	200	--	--	--	--
Establish and maintain coordinative communication	4.1	BER	I&E	ongoing	300	300	300	300	300	300
Develop brochures, posters, and visual aids	4.2	BER	I&E	1987	3000	1000	1000	--	--	--
Prepare magazine articles	4.3	BER	I&E	ongoing	400	400	400	400	400	400
TOTALS					72,700	62,900	60,700	59,100	58,600	58,600

*BER = Bureau of Endangered Resources
BWM = Bureau of Wildlife Management
RES = Bureau of Research
I&E = Bureau of Information and Education
BLE = Bureau of Law Enforcement
NHI = Natural Heritage Inventory Section of BER
P&R = Bureau of Parks and Recreation

BER will initiate and coordinate all activities.

(1) 10-20 birds at $2,000/bird.
(2) An attempt will be made to have most materials and labor donated.
(3) Food = coturnix quail; 100 quail/falcon (at $2/quail)

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Part II. BACKGROUND

A. Status and Distribution

1. Wisconsin

Former: F. p. anatum (American peregrine falcon) - "was never very common in any part of the state" (Kumlien and Hollister 1903). From 1940 to the early 1960's, at least 24 different peregrine eyries (nests) were used by breeding pairs; these eyries were located along the Wisconsin side of the upper Mississippi River, along the lower Wisconsin River, in Door County, and along the St. Croix River in northwestern Wisconsin (White 1969).

This species was also "of regular occurrence during the migrations, both spring and fall, principally along the water courses" (Kumlien and Hollister 1903). Some of these migrating peregrines were probably of the anatum subspecies from the boreal forest area of Canada, but a large portion of these migrants were probably F. p. tundrius (Arctic peregrine), the highly migratory subspecies considered part of the anatum subspecies until 1968 (White 1969).

Current: F. p. anatum - extirpated as a breeding species in Wisconsin (Berger and Mueller 1969, Fyfe et al. 1975). Peregrines were last known to have successfully fledged from a nest in Wisconsin in 1962; the last adult peregrine observed during the breeding season was in 1964 (Berger and Mueller 1969). All peregrines seen since then have been migrants or nonbreeders until 1986.

Estimated numbers: In 1955, there was about one pair of peregrines per 64 km. along the Wisconsin side of the Mississippi River (Berger and Mueller 1969). In 1986, 1 pair nested on the Mississippi River and two additional territories were occupied.

F. p. tundrius - most of the peregrines that migrate through Wisconsin probably breed on the tundra. These migrants, although few in number, can be seen as they fly along the Lake Michigan shoreline or the upper Mississippi River. In 1951, observers at Cedar Grove Ornithological Station near Lake Michigan saw just under one peregrine per day as these falcons traveled south to their wintering grounds; this observation rate has since declined to only one peregrine seen every four days during the fall migration (Berger, unpublished data). (See Figure 2).

Reasons for change of status: The primary factor involved in the decline of several peregrine falcon populations in both North America and Europe is the widespread use of pesticides, especially DDT, from 1946 to 1972 (Ratcliffe 1970, Peakall 1976, Bollengier 1979). Birds such as the peregrine that are on top of a long food chain are most susceptible to the harmful effects of these chemicals.

Other factors that might have affected peregrine numbers locally include egg-collecting, taking of young by falconers, diseases, environmental contaminants, predation by great horned owls and raccoons, and long-term changes in climate. However, none of these factors can account for the precipitous population crash that overtook this species after World War II (Hickey and Roelle 1969).

2. U.S./Continental

Three subspecies of Falcon peregrinus are found in North America: F. p. pealei which breeds along the Alaskan coast and the coastal islands of British Columbia; F. p. tundrius which nests north of the tree line in the arctic portions of Alaska and Canada; and F. p. anatum which previously nested south of the tree line throughout the rest of continental North America (Blood 1973). The anatum subspecies has been extirpated in the United States east of the Rockies and breeds sparingly in the taiga portions of Alaska and Canada, in Baja California, central Arizona, southwest Texas, Mexico, Colorado and Quebec (Snow 1972) (Figure 3). Of these three subspecies, only pealei is not considered federally endangered or threatened.

B. Life History

Peregrine falcons have been highly prized for use in the sport of falconry. In the Middle Ages, the peregrine was reserved for use by royalty because of the bird's great intelligence, strength and spectacular aerial performance (Grossman and Hamlet 1964).

1. Physical Characteristics

This crow-sized bird has the characteristic hooked bill and powerful taloned feet of a raptor. As is common in birds of prey, the male is smaller than the female. Males are 15-18 inches (38.1-45.7 cm) tall and weighs 20-25 ounces; the female is 18-21 inches (45.7-53.3 cm) tall and weigh 32-40 ounces. The long, pointed wings have a wingspan ranging from 40 to 45 inches (101.6-114.3 cm). The peregrine is smaller and more streamlined than most buteo hawks.

The adult peregrine falcon has a black cap and a characteristic black stripe or "moustache" below the eye. The throat and underparts are white. Blackish-brown bars occur on its sides, thighs, abdomen, underwings and lower breast. The back and upper wings are slate colored. Eyes are dark brown with yellow eye-rings. The feet and legs are yellow; the bill is slate blue. Like a pigeon, it flies with rapid wing beats.

Immature peregrines resemble adults except that the undersides are streaked with brown. The head is generally dark with a dark band around the eye and across the cheek. The back and wings are dark brown to black. Bluish-gray is the color of the bill, legs and feet.

2. Presence in State

The peregrine falcon is native to North America and has been present in Wisconsin since recorded history. At present, the peregrine occurs mainly as a migrant, although 3 breeding territories were active in 1986.

3. Migration

See Habitat

4. Mating and Reproductive Biology

Peregrines choose a mate in spring. Males perform aerobatics and a "wichew" call during courtship. Adults are usually 2 or 3 years old at first breeding.

The nest or eyrie is merely a scrape on a ledge or cliff often sheltered by an overhang; no nest material is brought to the site. Buildings and bridges have also been used as nesting structures. The same site may be used year after year. Three to five eggs are laid. They are creamy-white with red-brown spots. The 32-33 day incubation responsibilities are shared by both parents. Upon hatching young are covered with creamy-white down and their feet are noticeably large. Within 35-45 days, the young are ready to leave the nest. Renesting may or may not occur if the first attempt fails. Territoriality keeps nests one or more miles apart.

5. Natality and Mortality

Tordoff (1986) developed the following survival and reproduction information based on 56 released falcons in Minnesota between 1982 and 1985.

- Forty percent first year survival
- Eighty-five percent annual survival after the first year.
- Sixty percent of adult falcons will breed successfully.
- Age at first breeding: two and a half years.
- Successful nesting pairs produce an average of two young.
- Emigration and immigration, if any, are equal.

Predators include the raven, crow, fox, raccoon, great horned owl and humans.

6. Habitat Requirements

Peregrine falcons occur worldwide. In North America, breeding can occur over most of the continent - from Alaska to Mexico. Preferred nesting sites include high ledges near open water. In Wisconsin, these sites were usually located on the steep bluffs associated with the upper Mississippi and Wisconsin Rivers, or on cliffs in Door County.

7. Food and Feeding Behavior

Almost the entire diet of the peregrine falcon consists of small to medium-sized birds - flickers, robins, sparrows, meadowlarks, etc. The peregrine plucks its prey before it is eaten.

Hunting takes place in open areas at dawn and dusk. This bird's hunting style is to fly high above its prey and swoop down upon it. Most prey is struck while in flight. If not caught on the first blow, the stunned prey is often caught while still in mid-air.

Young are taught to catch prey as adults fly by with prey, encouraging young to take it from them while in mid-air.

C. Wisconsin Habitat

1. Nesting habitat: Peregrines usually make their nest scrapes on ledges, holes or recesses in cliffs of either igneous or sedimentary rock (Snow 1972). In Wisconsin, most cliff nests have been located on the steep bluffs along the Mississippi and Wisconsin Rivers, or on cliffs in Door County (Berger and Mueller 1969). In other areas, this species has also been known to nest in cutbanks of rivers, on very large dead trees, on the ground in the arctic, and on tall buildings and bridges (Brown 1968).

2. Migration habitat: The only North American peregrines that are truly migratory are those that breed in the far northern parts of the continent - F. p. tundrius, and a small portion of the anatum subspecies. These birds usually migrate along coastlines, lake shorelines or along rivers. Most tundrius migrate along the Atlantic seaboard; fewer individuals pass through the plains and midwestern states (White 1969). In the Midwest, the major migratory routes include the shorelines of the Great Lakes and major rivers such as the Mississippi.

3. Wintering habitat: Most migratory peregrines winter in fairly open habitats -- particularly shores, marshes and highlands -- of southern United States, Central America and parts of South America (White 1969, Beebe 1974, Bent 1938). There is no wintering habitat known from Wisconsin.

4. Essential habitat: Historical nesting sites will prove to be essential for implementation of a reintroduction program.

D. Limiting Factors

As mentioned previously, the widespread use of organochlorine pesticides after World War II has been shown to be a major factor in the drastic decline in peregrine numbers in the U.S. and Europe. Other environmental factors such as climatic changes, availability of prey, predation, and human disturbance may also have played a role in the decline of certain local populations. Vegetative succession may preclude use of some historically used cliffs.

E. Research and Management

RESEARCH

Berger and Mueller (1969) made a survey of nesting peregrines along the Wisconsin side of the upper Mississippi River from 1952-1965. The history of use of other peregrine eyries in the state was also reported. Inventories of the number of peregrines migrating along Wisconsin's Lake Michigan shoreline have been made at Cedar Grove Ornithological Station every fall since 1951 (Figure 2).

MIGRATION CENSUS METHOD

Annual counts of peregrines that are observed during fall migration at Cedar Grove Ornithological Station, Wisconsin. Daily counts are made of the total number of each raptor species seen.
Occurrence: Each fall from September to late November.
Time of survey: Dawn-to-dusk observation period.
By whom: Daniel D. Berger, Helmut C. Mueller (in past years), George Allez (recent years) and other volunteers.

MANAGEMENT

Major efforts are being made to save the peregrine falcon by means of captive propagation and restocking to the wild in areas that had previously been part of the bird's range (Cade and Temple 1977, Fyfe et al. 1977). A healthy proportion of the captive-reared young released to the wild in parts of eastern U.S. have returned to their release sites after a short migration southward during the winter (Temple, pers. comm.). In 1980, three pairs of released peregrines established territories at hack towers on the New Jersey coast and two nested successfully (Cade and Dague 1980), marking the first time since the 1950's that wild peregrines fledged their own young east of the Mississippi River. Since then, peregrine nesting activity has increased dramatically in the Atlantic Coastal Region. In 1984 at least 16 pairs attempted to nest, and 12 pairs were successful, producing 30 young.

The State of Minnesota is proceeding with a restoration project including hacking of young from a tower platform. The project began with the release of the first five falcons along the Mississippi River in 1982 at Weaver Dunes, south of Wabasha, Minnesota. Subsequent releases at Weaver Dunes in 1983 and 1984 as well as an additional site on the North Shore of Lake Superior which became operational in 1984 brought the total number to 31. A total of 25 falcons was released in 1985: 6 in downtown Minneapolis, 7 on the North Shore of Lake Superior and 12 at Weaver Dunes. At this level of release, the release project is approximating the annual historical production of the former peregrine population in Minnesota. The effort in 1986 eclipsed all previous work by the release of 36 falcons in Minnesota, 5 in Chicago, and 5 in Grand Rapids, Michigan.

In 1986, three pairs of falcons returned to natural cliff sites along the Mississippi River, all within a 20 mile radius of the hack site at Weaver Dunes. These sites were all historically occupied cliffs and at no time did the returning falcons exhibit any interest in returning to the towers for nesting. Of the 3 pairs, only one chick was produced -- it disappeared prior to fledging.

Initial efforts at restocking peregrines to some of the traditional eyries in Wisconsin failed. Five peregrines were released along the upper Mississippi River in 1976; none of these birds returned to the release site (Appendix 3). Three more young peregrines were to be released in 1977, but after the first two birds were killed by great horned owls, the third was returned to Cornell University (Appendix 4).

Part III. BIBLIOGRAPHY

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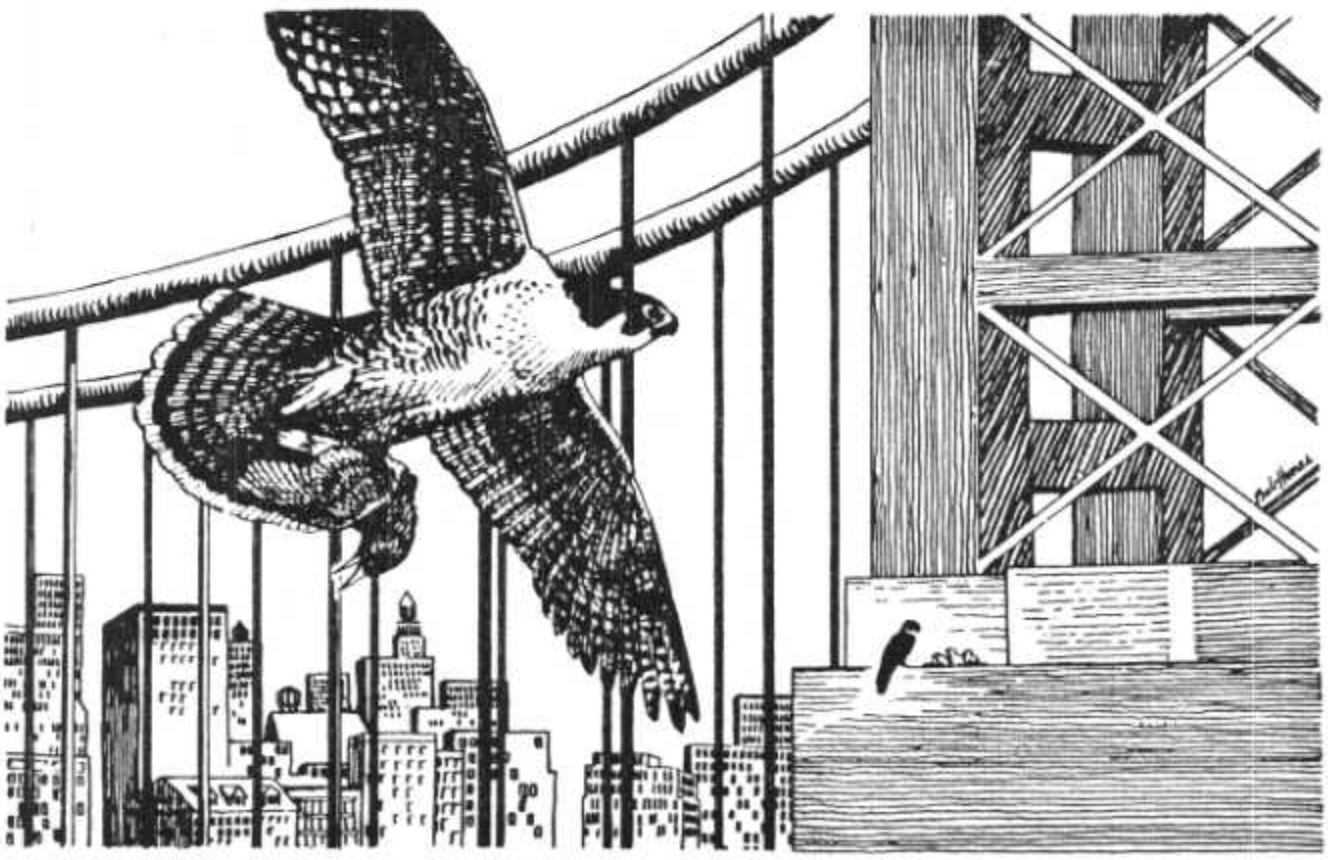


Part IV. SUPPORTIVE MATERIALS

Figure 1.

PEREGRINE FALCON LIFE TABLE

	1987	88	89	90	91	92	93	94	95	96	97	98	99
1987	20	8	7	6	5	4	4	3	3	2	2	2	1
1988		20	8	7	6	5	4	4	3	3	2	2	2
1989			20	8	7	6	5	4	4	3	3	2	2
1990				20	8	7	6	5	4	4	3	3	2
				4	**2**	**1**	**1**	**1**	**1**	-	-	-	-
1991					20	8	7	6	5	4	4	3	3
					8	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**
1992						20	8	7	6	5	4	4	3
						10	**4**	**3**	**3**	**2**	**2**	**2**	**2**
1993							20	8	7	6	5	4	4
							14	**6**	**5**	**4**	**3**	**3**	**2**
1994								20	8	7	6	5	4
								16	**6**	**5**	**4**	**4**	**3**
1995									20	8	7	6	5
1996										22	9	7	6
1997											24	10	8

□ Birds hatched in the wild

other numbers indicate birds hatched in captivity

ANNUAL BREEDING PERFORMANCE

	Adult Pairs	Breeding Pairs	Young Produced	Total Population
1990	4*	2	4	45
1991	6	4	8	56
1992	8	5	10	68
1993	11	7	14	75
1994	14	8	16	85
1995	17	10	20	77
1996	18	11	22	76
1997	20	12	24	79

Survival, mortality, etc. rates are based on those described in the following article (Tordoff, 1986).

* Includes 100% of 3 year olds and 20% of 2 year olds.

James Ford Bell
Museum of Natural History

Natural History LEAFLET

April 1986 Number 3

A Peregrine Falcon Life Table

by Harrison B. Tordoff

Like these peregrines in Edmonton, Alberta, peregrines may soon be nesting on buildings in the Twin Cities. Photo courtesy of Gary Erickson and the Edmonton Journal

Peregrine falcons symbolize, for many people, the potential for disaster inherent in human attempts to manipulate the environment. Unwise use of the insecticide DDT in the 1950s eliminated the peregrine from eastern North America. As a result of feeding at the top of the food chain, on birds that ate insects that were contaminated with DDT, peregrines built up large levels of DDT in their fatty tissues. The poison disrupted peregrine breeding, making their egg shells too thin to withstand incubation.

When falconers recognized the scale of the disaster they began a major effort to learn how to breed peregrines in captivity.

Today, thanks to a reintroduction program led by ornithologists at Cornell University, peregrines are on the rebound. A growing population of peregrines nests in the eastern United States.

The Cornell-led program hopes to reestablish 175 breeding pairs in the East, one-half the pre-DDT population of 350 pairs. If the reintroduced birds breed according to expectations, the population will continue to increase to the East's current carrying capacity for peregrines, determined mostly by the number of available nest sites on cliffs, tall buildings and bridges.

The Minnesota Peregrine Project began releasing falcons in 1982 with the goal of reestablishing about 15 to 20 breeding pairs, half of the pre-DDT population of the upper Mississippi valley and the Minnesota North Shore. Our program has reached the point where in 1986 or 1987 we might again see peregrines nesting after a 25-year absence.

This is an appropriate time, then, to pause and evaluate our plans for completing the task of restoring these magnificent birds to the upper Midwest. We must estimate the costs of completing the effort, evaluate the potential for success, and plan for ending releases when our goals are met.

Projecting the Future of Minnesota Peregrines

In order to evaluate the effectiveness of our reintroduction program and to make predictions about the growth of the peregrine population in Minnesota we use a life table, a statistical tool that summarizes the survival and reproductive performance of a species under specified conditions. In this case the life table is based on the 56 falcons released in Minnesota from 1982 through 1985, and the projected release of 30 falcons a year from 1986 through 1990 (a realistic number, given the availability of funds, young falcons, and release sites).

Projections in the table are based on the following assumptions about the biology of peregrines. The usefulness of the projections is limited by the accuracy of these assumptions.

Biological Assumptions About the Peregrine Falcon

Forty percent first year survival (for every 100 falcons fledged, 40 survive to their first birthday). Several studies of both wild and released peregrines support this assumption. Of the 56 peregrines released to date (1982 through 1985), we know of only six casualties, though undoubtedly some mortality has gone undetected.

Eighty-five percent annual survival after the first year (after the first year, for every 100 falcons, 85 will be alive one year later). A carefully studied population in northern England and southern Scotland had an annual adult survival of 89 percent. Other populations have shown adult survival rates ranging from 80 to 85 percent. Field studies tend to underestimate adult survival because of the difficulty of accounting for birds that may move out of the study area.

Sixty percent of adult falcons will breed successfully. Some adult falcons may fail to find mates or suitable nesting sites. Others may lose their eggs or young to predation, starvation, or accidents. An average of about 60 percent of the adults fledged young in several studies.

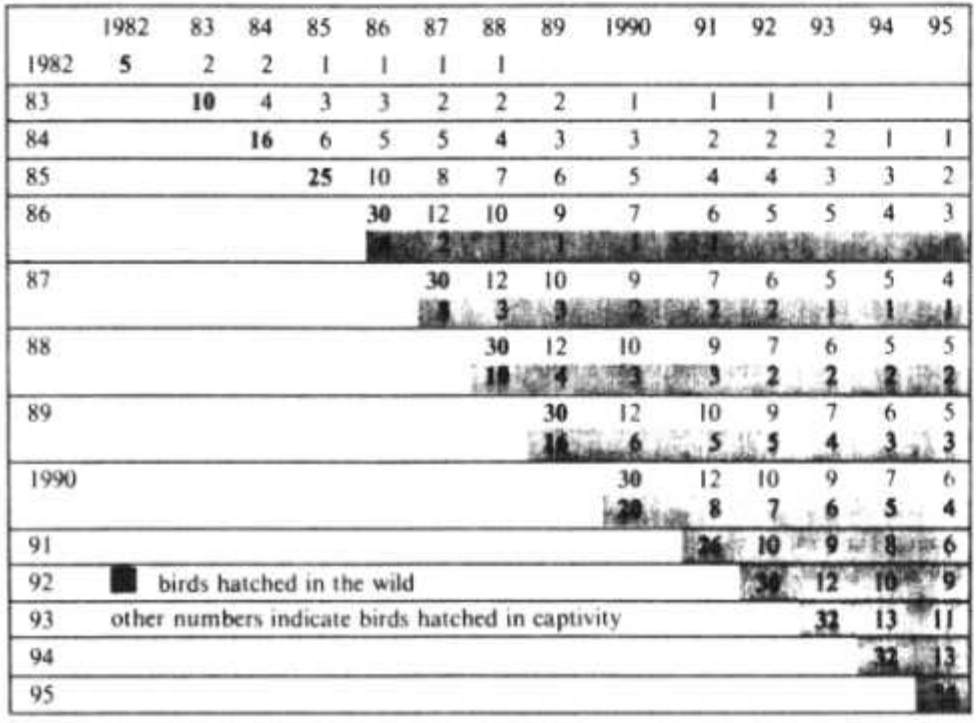
Age at first breeding: two and a half years. In most populations studied, a few peregrines breed at one year, some begin at two, and some begin at three. Peregrines released into habitats lacking adults tend to start breeding at younger ages. As adults accumulate in the population, they exclude younger birds from the best nest sites and the age of first breeding goes up.

Successful nesting pairs produce two young. This is probably conservative for our area, at least for the Mississippi population. North Shore birds may be less productive because their midsummer food base is probably poorer. The average production of young per

successful pair, from eight peregrine populations studied, ranged from 2.36 to 2.72. The highest productivity, 2.72 young, was from 47 successful nestings by the newly established eastern U.S. population of released birds.

Emigration and immigration, if any, are equal. The midwestern peregrine population is separated from the eastern and western United States populations by about a thousand miles, and from Canadian release sites by a minimum of 500 miles. Substantial interchange of falcons at this stage of the reintroduction seems unlikely.

Peregrine Falcon Life Table



The boldface number at the start of each horizontal line is the number of falcons released or fledged in the wild each year (actual, 1982-85; expected 1986 on). Successive figures on each horizontal line represent the expected number of falcons of that year's cohort surviving from year to year. Each vertical column gives a snapshot of the age distribution of the population in any given year. Adding any vertical column gives the expected total number of peregrines in the region for that year.

Example: *In 1988 we will release 30 falcons and an additional 10 young should be produced by wild birds. By moving to the right on that line, we get survivorship estimates for those 40 birds in 1989 and subsequent years.*

Reading vertically, we see that in 1988 the population will include, in addition to the 40 hatching year birds, 15 one-year old birds, 11 two-year olds, 7 three-year olds, 4 four-year olds, 2 five-year olds, and 1 six-year old peregrine from our first release.

Annual Breeding Performance

	Adult pairs	Pairs breeding	Yg. produced	Total pop.
1986	3	2	4	53
1987	6	4	8	68
1988	9	5	10	80
1989	13	8	16	96
1990	17	10	20	109
		(releases end in 1990)		
1991	21	13	26	96
1992	25	15	30	100
1993	27	16	32	104
1994	27	16	32	105
1995	28	17	34	109

This table summarizes the peregrine breeding performance, calculated from the life table. Assumes release of 30 falcons each year through 1990.

Peregrine Prospects

The peregrine releases of 1982 through 1985 —56 birds — are now history. We expect to release another 150 falcons by 1990, for a total of 206 reintroduced birds. If releases cease in 1990, and all goes as planned, the 1991 population will consist of 21 adult pairs. Using the assumptions of the life table, 13 of the pairs will breed successfully that year and produce 26 young. The annual August population in our region after 1992 should be over 100 birds.

We estimate from published records and the recollections of field observers that 30 to 35 breeding pairs made up the original pre-DDT population in the upper Mississippi River drainage and the North Shore. If we reach our projected population of 21 adult pairs by 1991, we can consider the restoration project successfully completed. The population should continue to grow slowly, eventually reaching the carrying capacity of our region and providing a surplus of birds for natural recolonization of scattered sites in Michigan, Wisconsin, Iowa, the Boundary Waters Canoe Area, and Lake Superior cliffs in Ontario.

At this midpoint in our peregrine program, eventual success seems assured, thanks to a great cooperative effort by many individuals, and the University of Minnesota Raptor Clinic and the Bell Museum of Natural History. The Nature Conservancy, the Minnesota Falconers Association, the Minnesota Department of Natural Resources Nongame Wildlife Program, U.S. Fish and Wildlife Service, U.S. Forest Service, the Cornell University Peregrine Fund, and the Wisconsin Department of Natural Resources Nongame Program.

Harrison B. Tordoff is Professor of Ecology and Behavioral Biology at the Bell Museum of Natural History.

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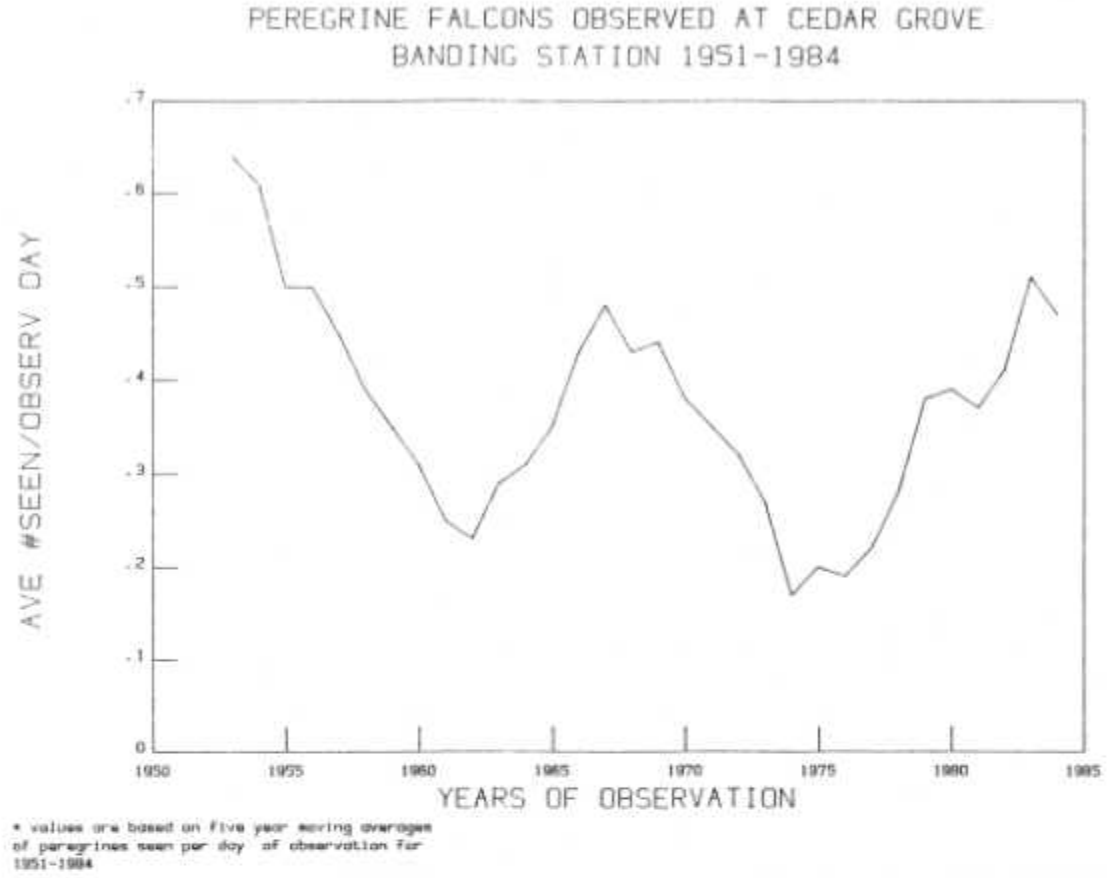
The Bell Museum of Natural History, a department of the University of Minnesota, is located at 17th and University Avenues S.E., Minneapolis. Museum hours are Tuesday through Saturday, 9 a.m. to 5 p.m.; Sunday 1 p.m. to 5 p.m. For more information call 373-2423.



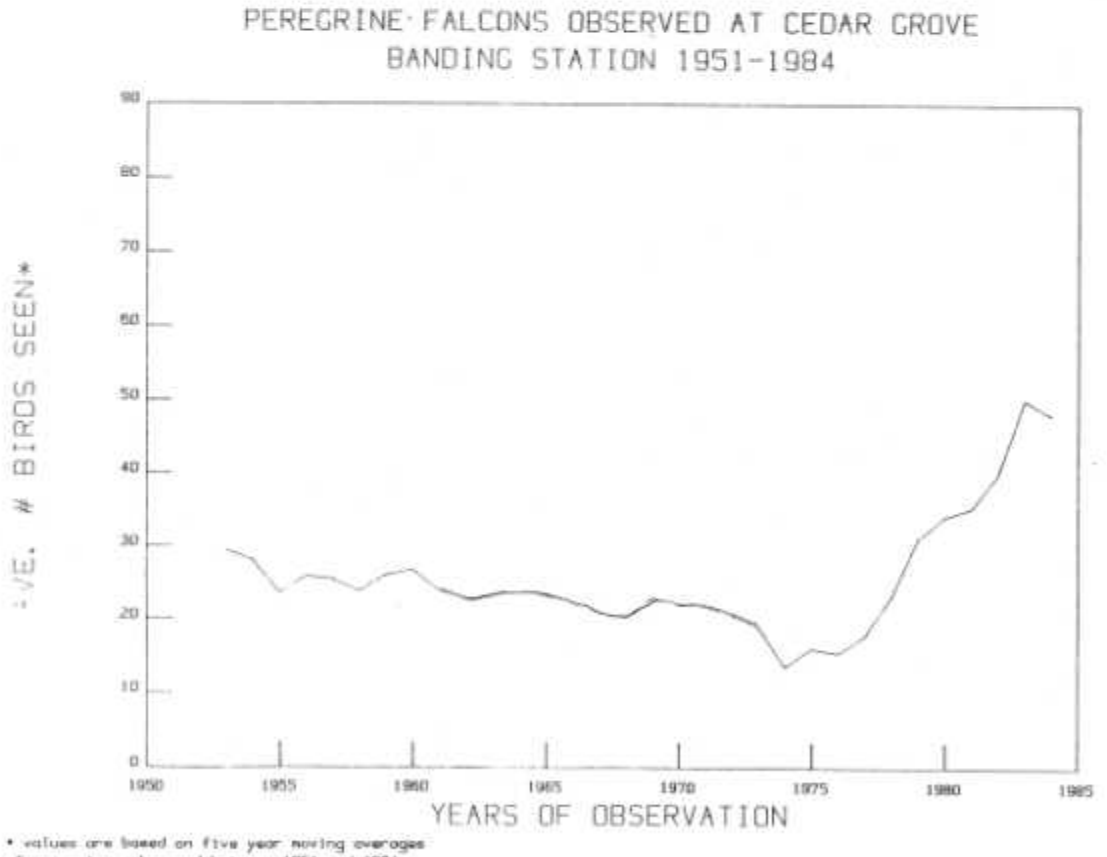


Figure 2. Trends in the fall observations of peregrine falcons during migration as recorded at Cedar Grove Ornithological Station, Wisconsin. From: Berger, unpublished.

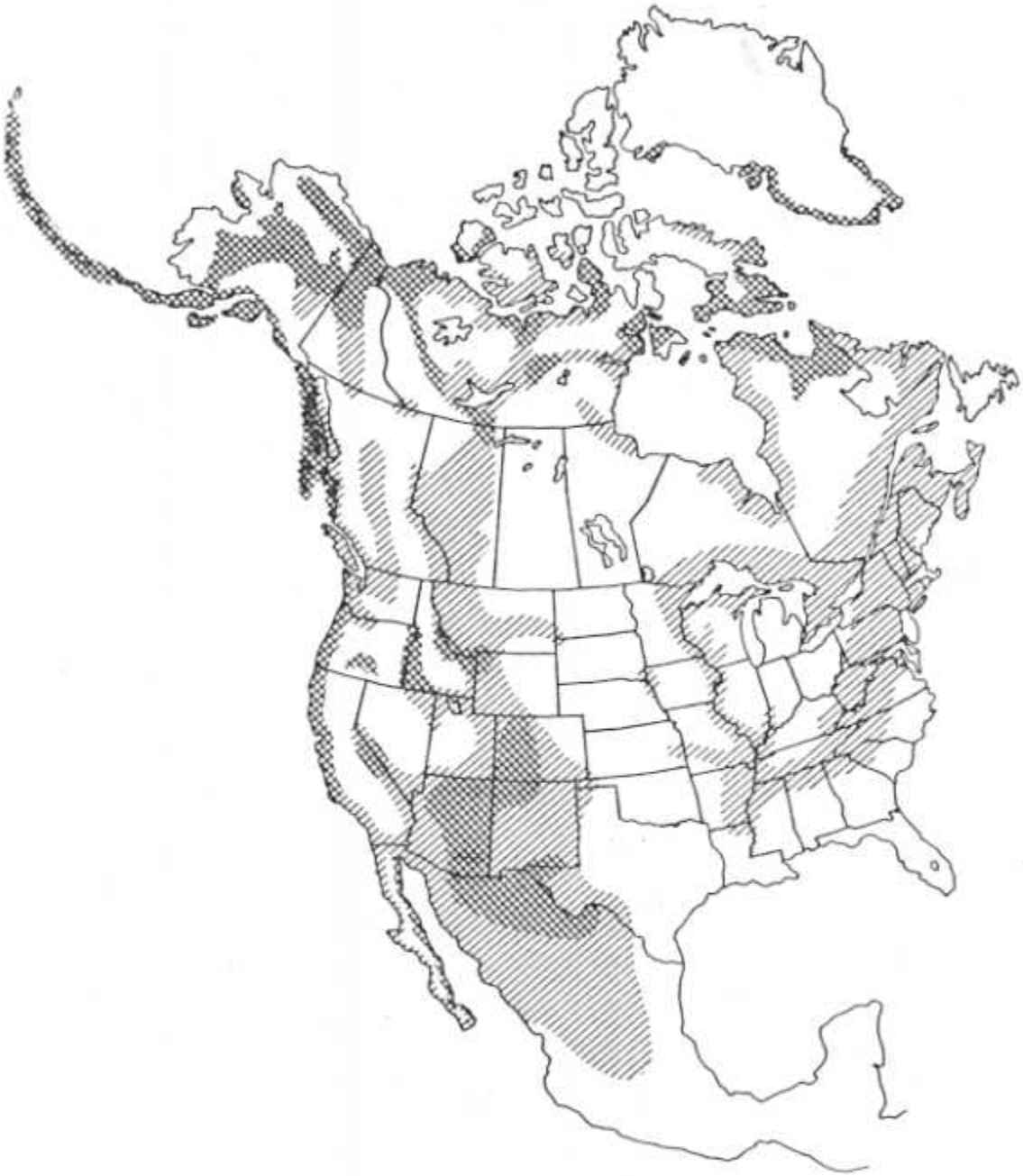


Figure 3. The breeding range of Falco peregrinus in North America. Hatching indicates approximate known historical range, and crosshatching indicates approximate known range from 1970 to 1975. Falco p. anatum breeds south of the tree line; F. p. tundrius breeds north of the tree line, and F. p. pealei breeds on Pacific coastal islands and the Aleutians. From: Fyfe et al., 1975.

Appendix 1

EYRIES INVENTORY AND SITE ASSESSMENT FORM

EYRIE #_____

A. LOCALITY

1. State:
2. County:
3. Distance and direction to nearest town:
4. Name of Site (if named)
5. Attach map with locality marked.

B. PHYSICAL STRUCTURE OF CLIFF

1. Type of substrate: _____, Stability of substrate:_____.
2. Maximum vertical height of cliff face:_____.
3. Horizontal extent of cliff face:_____.
4. Direction cliff faces:_____.
5. Estimate number of suitable perches_____, ledges_____, potholes_____, (mark on photograph if possible).
6. Accessibility of nest ledges:
7. Habitat directly above cliff:_____.
   Directly below cliff:_____.
8. Approach distance to cliff by foot_____, climbing_____, boat_____.

C. SURROUNDING HABITAT

1. Distance to nearest water_____, type of water body_____.
2. Distance to nearest road in front of cliff_____, behind cliff_____.
3. Distance to nearest building in front of cliff_____, behind cliff _____.
4. Percentage of land within a mile radius of cliff that is under water _____, coniferous forest_____, deciduous forest_____,pasture_____, cultivated crops _____, marsh _____, built-up areas_____,rock_____.
5. Distance and direction to nearest alternative nesting cliff: _____.
6. Type of and distance to nearest disturbance factor:

D. UTILIZATION OF CLIFF BY NESTING BIRDS

1. Past history of peregrine occupancy and sources of information:
2. Evidence of present raptor occupancy: whitewash_____, stick nest_____, nest scrapes_____, pluckings_____, castings_____, other_____.
3 Past and present occupancy by other raptors:
4. Non-raptorial birds nesting or roosting on cliff:

Appendix 1 (Continued)

EYRIES INVENTORY AND SITE ASSESSMENT FORM

E. AVAILABILITY OF PREY DURING NESTING SEASON

	Absent, present or common	Source distance from cliff
Pigeons:		
Shorebirds:		
Waterfowl:		
Starlings/blackbirds:		
Other birds:		

F. SOURCE OF INFORMATION

1. Observer: _____
2. Date of visit: _____. Time of visit: _____ to _____.
3. Describe how cliff was examined (aerial view, binoculars, spotting scope, above or below cliff, climbing).

4. Hours spent examining cliff: _____.
5. Names, addresses and phone number of local contacts:

G. COMMENTS ON SUITABILITY OF CLIFF FOR PEREGRINE REINTRODUCTION

H. SKETCHES OF CLIFF, MAPS, PESTICIDES INFORMATION AND ADDITIONAL COMMENTS

Appendix 2

PEREGRINE FALCON MANAGEMENT PLAN FORMAT

(Information on each eyrie will be kept in confidence of the Recovery Team, immediate cooperators and assigned investigator.)

I. GENERAL INFORMATION

A. State: _____
B. County: _____ U.S.G.S. quadrants _____
C. Nearest Town: _____ Distance: _____
Direction: _____
D. Name of site (if named): _____
E. Recommended Lead Agency: _____
F. Recommended Cooperators: _____

USE FOR NEST SITES ONLY: EYRIE # _____

G. Type of Release: Hacking: _____ Foster Parent: _____
H. Nesting Ledge: Artificial: _____ Natural: _____

USE FOR STOP-OVER OR WINTERING AREAS ONLY:

I. Type of use by birds during migration: 1. Wintering: _____
2. Stopover: _____

II. INFORMATION NEEDED

A. Nest or Release Site:

1. Outline actions, priorities, schedules and costs for each site, using information assembled in 2-13 below:

2. Conduct land ownership survey on and around site out to a one mile radius: private (landowner's name), state, federal, etc.

3. Describe existing human disturbance: recreational use such as hiking, climbing, hunting, camping; highways; housing developments; temporary residences; industrial development; commercial development; location of any power lines, etc. Locate on topographic maps.

4. Investigate site vulnerability to future site encroachment: land use changes.

5. Describe actions necessary to protect site: cooperative agreement, lease, easement, acquisition. List agency or individual who would enter into agreement.

Appendix 2 (Continued)

6. Specify site preparation needs: hacking station construction materials and needs, observation blinds, hacking attendants, perch pole, feeding ledge, eyrie attendants, etc.[1]

7. Describe general habitat types at release and nest sites and out to a 10 mile radius: marshes, mountains, forests, lakes, fields, rivers, built-up areas, etc.

8. Define available prey base and specific habitat supporting this base: list typical prey by species such as flickers, bluejays, pigeons, waterfowl, shorebirds, etc.

9. Assemble history of organochlorine application in area: location and distance from site, dates of use, chemicals used.

10. Describe natural predators present and location: great horned owls, raccoons, etc. Suggest means of control if needed.

11. List names and means of contacting responsible state and federal law enforcement officials.

12. Determine open space available for peregrine hunting up to a 10 mile radius: waterways, wetlands, open fields, etc.

13. Describe any future management practices necessary to insure survival of both peregrines and their prey, such as: manage and manipulate habitat at a particular location to increase prey base, provide erosion control or dune protection, restore vegetation, etc.

B. Stop-over or Wintering Areas Utilized During Migration:

1. Outline actions, priorities, schedules, and costs for each area, using information assembled in 2-5 below.

2. Define peregrine movements, winter food habits and supporting habitat in the general area.

3. Conduct land ownership survey for any area that contains essential habitat: private, state, federal, etc.

4. Document and cite past and present usage of the area by migrating peregrines.

5. Collect information described in 3, 4, 5, 8, 9, 11, 13, under IIA: Nest or Release Site

Further Remarks: Other possible sources of information: Local planning and zoning boards; county agriculture agent; county, town or city clerk; highway department. Use topographic maps and locate significant features.

[1] A release site coordinator will be available to assist agencies determining needs to release birds (Items 16 and 17 in Implementation Section).

Appendix 3

EASTERN PEREGRINE FALCON REINTRODUCTION PROGRAM
1976 SUMMARY REPORT

THE PEREGRINE FUND
Cornell University Laboratory of Ornithology
159 Sapsucker Woods Road
Ithaca, New York 14853

Maiden Rock, Mississippi River, Wisconsin, prepared by M. Fuller

1. Personnel at Hack Station.--Mark R. Fuller and Jane Gull, Bell Museum of Natural History, University of Minnesota, Minneapolis, Minnesota 55455.

2. Description of Site.--The Mississippi River release site is located 2.2 miles south of the town of Maiden Rock, Wisconsin. The hack box faced southwest and was placed in a cave on a 60' rock face. The box was 35' from the top of the rock, which rises 300' above the Lake Pepin portion of the Mississippi River. A road and railroad lie between the cliff and the shoreline.

Agricultural fields extend to the cliff top. Crops of corn, soybeans, alfalfa, and hay are most common. The corn field immediately above the release area was bordered by a new white pine planting which extends to the hill top.

The hillside above the box is dominated by bur, pin, and red oak, and basswood, with sugar maple and occasional shagbark hickory. At the top edge of the cliff eastern red cedars are common. Some red cedars grow at the base of the cliff, and the hillside below the cliff contains the same tree cover as above. Cottonwoods are the dominant tree between the road and railroad tracks, and railroad tracks and shoreline.

Common understory shrubs include poison ivy, ironwood, woodbine, Prunus species, and staghorn sumac along the roads.

3. History and Identification of Young Falcons.--

Peregrine Fund Identification	Name	Hatching Date	Federal Band	Age at Placement in Days
100 ♀ U 72-4	Righty	6/20/76	877-115-96	33
13 ♀ U 72-1	Lefty	6/17/76	877-115-97	36
13 ♂ U 8-4		6/19/76	576-892-40	34
14 ♂ U 81-1	Spot	6/17/76	576-892-41	36
3 ♂ U 81-2		6/18/76	576-892-42	35

All five young were placed in the hack box on 7/23/76.

4. Pre-release Details.--A 30', 6" pipe leading from the top of the cliff to the front of the box permitted feeding of the birds without them viewing us. On the evening of 7/23/76 we stapled and wired hardware cloth across the front of the box as a precaution against raccoon depredation. The box was checked from the front on three occasions in order to determine whether or not too much food was accumulating. On 8/2/76, by using a predator call we attracted a Great-horned Owl to the area above the box and shot it. The box was opened on 8/3/76 in order to attach the leg-mounted transmitters.

5. Fledging Details.--The hack box was opened at 1400 on 8/4/76, eleven days after the falcons had been placed in it. At 1435 the first bird hopped out of the box onto the ledge about 6" below. Two others went to the ledge between 1445 and 1500. Behavior throughout this time consisted of wing flapping, hopping, and walking about the ledge and front of the box, picking at food, preening, and watching birds, cars, people, etc.

The first flight occurred at 1607 when U 81-2 flew north along the cliff face 150 m, circled one time, and perched along the cliff. At 1857 a fourth falcon went onto the ledge. At 1959 a second male flew from the ledge to the cliff face about 175 m north. The third male flew from the box at 2007 while the two females fed inside the box. He flew about 150 m north and landed on the cliff face. The wind was gusty from the south throughout the afternoon. It began raining at 2013.

The females made very short flights from the box at 0829 (Lefty) and 1230 (Righty) on 8/5/76. Dr. Temple and I located U 8-4 along the railroad tracks at 1630 (see #13 for details). The other two males made flights on 8/5/76.

The Peregrines were marked as follows:

Bird	Peregrine Color Band	Wing Marker	Date of Tail Transmitter
U 72-4	AC5	Right Yellow	8/15/76
U 72-1	AC6	Left Yellow	8/16/76
U 8-4	AC7	Right Yellow	
U 81-1	AA9	Right Yellow with black spot	
U 81-2	AA0	None	

6. Development of Behavior--Pursuit of Prey.--On 8/5/76 at 1715 a Turkey Vulture drifted over the box. It appeared to "chase" Spot, but when it circled away from the box, Spot pursued it. Spot stooped on an insect at 0750 on 8/6/76. The following morning he stooped and hit what we believed to be a small bird. We heard the impact. He pitched back up as it dropped, dove at it again, and appeared to grab it, as he disappeared behind foliage. That afternoon he caught a butterfly in front of the box. Also on the afternoon of 8/7/76 Lefty stooped at pigeons, as she flew back and forth in front of the cliff face. The female's flights were not as aggressive as Spot's, but nevertheless the pigeons were obviously the object of her intentions. Righty was not observed to chase a pigeon until 8/12/76.

7. Dates of First Capture of Prey.--Spot captured at least one butterfly on 8/7/76. He may have captured a small bird also (see #6), but within a few minutes of his disappearance behind the foliage along the shore, Jane flushed him. He did not appear to carry any prey, and no remains were found in the area he had flown from. Mark flushed him from the road a few minutes later and again he did not appear to be carrying anything.

Early (0621) the morning of 8/12/76 one of the females was apparently successful in capturing an insect in flight as evidenced by her chasing behavior and dropping of the feet. Righty was seen picking at something on top of a telephone pole late the morning of 8/13/76.

8. Identification of Prey Captured.--Spot - Lepidoptera, possibly passerine; Lefty - Lepidoptera, Orthoptera; Righty - Lepidoptera, Orthoptera, Tree Swallow in post-juvenile molt, pellet. Pellets collected from the box and perches, which could be from either female. These data will be submitted soon.

9. General Hunting Techniques.--Spot's early stooping behavior had more vertical component to it than the females'. Additionally, he employed a pitch-up and second stoop at the small bird he may have caught on his fourth day on wing. Unfortunately, on his fifth day post-fledging (see #13 for details), Spot flew off.

Lefty's early chases after potential prey involved shallow stoops or changes in direction of flight toward prey as she flew. The chases appeared to be coincidental to perch-to-perch flights, or soaring-gliding flights. During this period Righty did not chase prey, despite the fact the pigeons often flew near her, or she was flying with Lefty when Lefty began a chase. Righty was considerably more vocal than Lefty. Righty did participate in intraspecific chases at this time. After 8/12/76 Righty pursued potential prey nearly as frequently as Lefty and their chases became more persistent and stoops more vertical. This persistence is best illustrated by their pursuit of prey over the lake, sometimes forcing birds very near or into the water. Most of their chases originated during more casual flight, or, less frequently, from perches on the cliff face or red cedar snags at the top of the cliff.

By 8/21/76 they began to chase single pigeons, which had become separated from the flock. A wider variety of birds were pursued (this may have been owing, in part, to more species and more individuals occurring in the area). Greater selection also seemed to take place as Ospreys and Red-tails were not chased as frequently.

A dramatic increase in flying and a change in flight behavior was noted on 8/26/76, following nearly a week of hot, humid, relatively calm weather. Both falcons began more high soaring and stooping (there was more wind), and also more prolonged flying and chasing as they moved into the field habitats on top of the hill for the first time. Lefty dispersed the next day, but Righty remained six more days. She demonstrated many stoops from altitudes of 500-1000', pitching-up and subsequent stooping after the initial dive, and more aggressive flight behavior. Additionally, however, it appeared that she employed "accipiter-like" hunting techniques, by flying from pole to pole or tree to tree along the railroad tracks, and by pursuing prey she flushed while flying close to trees and shrubs.

10. Roosting Behavior.--The three males roosted from 150 to 200 yards north of the box, on the cliff, the first night. The next two nights Spot and U 8-4 roosted about 100 yards and 20 yards north of the box, respectively. The females remained at the box the first two nights. Subsequent night roosts were usually on the cliff with both females being within 100 yards of the box. Occasionally we would last see a falcon on a red cedar snag, or on top of a telephone pole along the railroad tracks. No night roost was ever more than a mile from the release site. No particular rock, snag, or pole was used.

Day perches were also usually rock ledges, red cedar snags, or telephone poles if the falcons frequented the railroad tracks. Telephone poles were also used as perches when the birds used the field habitats. Both falcons generally stayed together.

Unusual perches and roosts included oak and live red cedar trees the first few days post-fledging, and oak tree night roosts a few times when Righty roosted above the hill, near the fields.

11. Dispersal from the Hack Station.--There was no sign of U 8-4 after 8/6/76, or of Spot after 8/7/76. It is believed both birds flew from the release area, although predation and/or transmitter failure and disappearance owing to other causes cannot be ruled out. Intensive telemetry and visual searches proved futile. Lefty was last observed the night of 8/26/76, Righty on 9/1. Righty's transmitter was functional when she dispersed, but ground searches that afternoon and an air search two days later revealed nothing. An adult Peregrine was observed passing along the lake on 8/28/76. Lefty, FWS band #877-11597, was found dead along a road two miles south of Prescott, Wisconsin, on 10/1/76, according to a report received by the Bird-Banding Laboratory at Patuxent. She had moved approximately 20 miles upriver.

12. Assessment of Individual Birds.--No assessment of U 8-4 or U 81-2 could be made. Spot appeared to be a very precocious bird, as evidenced by his chasing, greater number of flights, higher flying, and prey capture in the first few days after fledging.

The females were the last to fledge. Lefty consistently performed various behaviors before Righty. Lefty was the dominant bird in the air. Righty vocalized frequently when Lefty came into view, whereas the reverse did not hold as often. These females never night-roosted next to each other and only perched next to each other for short periods during the day. If they both tried to feed at the same time they would carry prey from the box. We believe both females were capable of hunting for themselves when they dispersed.

13. Unusual Incidents.--Peregrine U 8-4 was found about 400 yards north of the release site at 1615 on 8/5/76. He was on the ground, approximately 5 yards from the railroad tracks and 30 yards down a steep slope from the road. The bird was fairly alert, but did not fly. Inspection revealed a tuft of feathers missing above the right eye, and ruffled feathers on the right breast and right wing. After we removed his wing marker and color band the bird was released from a point on top of the cliff, 40 yards south of the box. He did not fly voluntarily, but when flushed glided out toward the lake, then turned and flew normally north and toward the cliff area 200 yards north of the box. There was no indication the falcon had moved by 1400 on 8/6/76. Dr. Tordoff and I found him dead at the base of a sheer rock face. The results of a necropsy by Dr. P. T. Redig, College of Veterinary Medicine, University of Minnesota, will be sent when completed.

Male U 81-2 flew 150 yards north, downwind, upon fledging. He remained in that area of cliff until 1200 on 8/5/76 when he moved south a short distance. He flew to a rock perch about 20 yards north of the box at 1630. He flew out of view to the north, but returned to the cliff 25 yards north of the box at 2000, and may have roosted in that area. He was not at this point the morning of 8/6/76 but returned to within 50 m of the box at 1258 and remained there until flying north out of view (about 120 yards) at 1350. On 8/7 and 8/8/76 intermittent radio signals for U 81-2 were received, but no visual contact was made and he could not be located more specifically than 0.5-1.5 miles north of the release site. No signal was received after 0800 on 8/8/76.

Spot was observed frequently until the morning of 8/8/76. He was not in the area presumed to have been his night roost for 8/7/76. His radio was non-functional. Intensive searching of the cliffs along Lake Pepin did not provide any sign of Spot or U 81-2.

The females allowed the approach of humans on foot within 20 yards. The falcons would vocalize prior to this, then flush. When people approached from above the cliff or telephone poles it was possible to come within 8-10 yards. Automobiles and trains passed within 10' before flushing the Peregrines. As their "fear" of people and vehicles appeared to be lessening as they grew older, we began to scare them from perches where they might be in danger. Only a slight improvement was noticed and they continued occasionally to fly within 10' of people and vehicles. The females' frequent use of the open area along the road and railroad tracks probably contributed to their becoming accustomed to the proximity of humans and vehicles.

The falcons vocalized when Turkey Vultures, Ospreys, Kestrels, and Red-tailed Hawks appeared near the release site. They chased these raptors regularly at first but less and less in later weeks. The Red-tailed Hawks seemed to evoke the least response, and in late August the falcons were observed soaring and gliding with them and harriers. Righty was perched nearby, and was later in the air when the adult Peregrine (which was feeding on a grackle-sized bird on wing) passed by. Righty made no obvious response to the Peregrine.

14. General Evaluation of Site and Methods.—The cliff around the release site provided excellent perching and roosting for the falcons. The cave in which the box was placed made a cool refuge for them on the southwest-facing cliff. The box was around a corner from the northern extent of the cliff. This may have prevented U 81-2 and U 8-4 from orienting to it after fledging. (Spot, however, passed by and perched in view of the box often, but never returned to it to feed.)

Though the site appears well situated from the standpoint of releasing falcons in an area for reestablishment, it presents two major problems from the standpoint of the initial release: (1) Because the falcons did not use the open fields above the cliff until late August, their attraction to open spaces led to spending a great deal of time along the road and railroad tracks. (2) The best areas for our observations were from the roadside below the cliff, and points on the clifftop near the box. Both areas left us conspicuously exposed and fairly close to the birds. Our activities along the road attracted many people. These situations may cause the falcons to become too accustomed to people and vehicles. We will look for areas where these problems can be reduced for next year's releases along the Mississippi River.

The telemetry equipment was very useful when it worked. The problem was transmitter failure. Leg-mounted transmitter antennas were broken off in six out of seven instances (Carroll Island and Mississippi releases). In four out of seven cases there was premature radio failure. The premature failure of the leg transmitters (Mississippi release) probably resulted from two factors: (1) These were converted tail-mount transmitters which were very erratic in performance; and (2) the tail-mount transmitters are longer than

AVM leg mounts, and have the antenna extending from the crystal end of the package. Thus when the birds landed the crystal could strike against the perch, greatly increasing the chances of damage and failure.

Until more efficient power sources become available a 60-day tail mount life is apparently too much to ask. We were warned of the possibility of premature failure. The late order of the transmitters precluded any testing of components or transmitters. A shorter life requirement, or harness mount (allowing larger battery), and testing will insure more reliable telemetry.

The ability to locate the Peregrines the first 7 to 10 days post-fledging can certainly increase initial survival. After that time it appears less likely that the attendants can prevent or remedy problems the falcons encounter. In view of this fact and the expense of transmitters and tracking logistics (mobile ground- and air-tracking of the wider ranging birds), it might be most efficient to use the leg-mounted transmitters until their batteries fail, then recapture the birds and remove the transmitters. If specific objectives can be accomplished with further tracking by tail- or harness-mounted transmitters they can be employed where adequate tracking support is insured.

The yellow wing markers provided excellent identification of flying birds when one could see the dorsal wing surface. When seen on the underside of the wing the marker was not as obvious but still very useful, as was the case with perched birds. One male's marker was not large enough and caused abrasion on the patagium. The falcons did not appear to pay excessive attention to the markers. A flapping noise, assumed to be caused by the marker, was frequently heard if a falcon glided or stooped nearby.

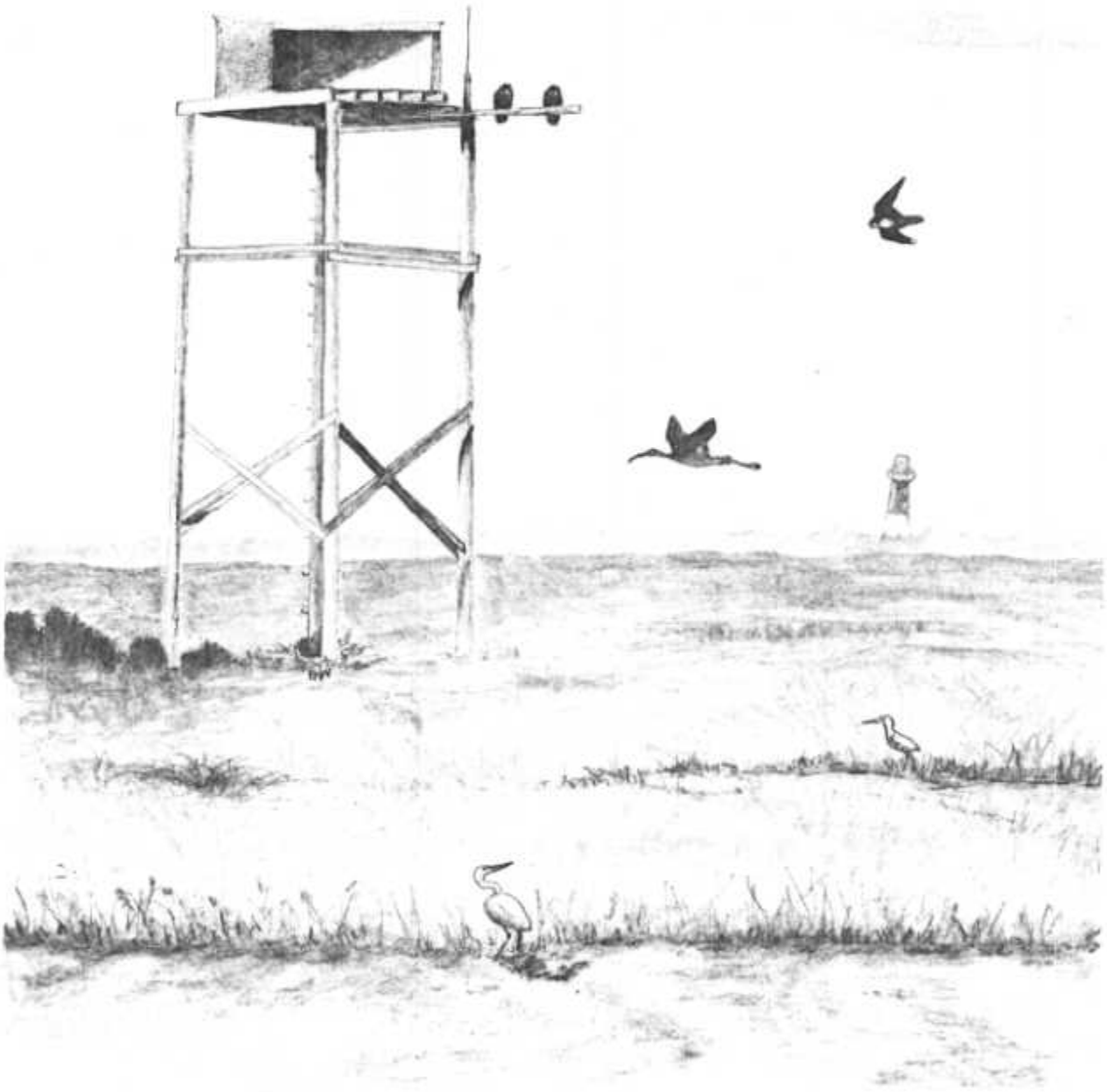
The Mississippi birds arrived with wing markers, and federal and color bands attached. One leg-mounted transmitter was mistakenly placed on the leg with the color band. Upon recapture (the injured bird), there was slight indication that this combination caused pressure on the top of the foot.

15. Conclusions.--The hacking technique appears to work quite well. I believe eight to ten birds could be released from one site. I would be very interested in discussing possible causes of and cures for premature departure of some birds. Social facilitation by a greater number of birds of the same developmental stage may be involved.

Enough transmitters should always be available. The conversion of the tail-mounted transmitters was unacceptable, and would most likely be impossible under most release site conditions.

The acceptance of the reintroduction program at the Mississippi site was very encouraging. More than 200 people stopped to inquire about our work and we spoke with many other area residents. We encountered no negative reactions. The regional Fish and Wildlife Service and State Department of Natural Resources were very helpful and cooperative. We also had excellent cooperation with the news media, and it seems the possibilities for enlisting cooperation and promoting education about raptors through these media should be expanded.

EASTERN PEREGRINE FALCON REINTRODUCTION PROGRAM
1977 SUMMARY REPORT



THE PEREGRINE FUND
Cornell University Laboratory of Ornithology
159 Sapsucker Woods Road
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Jay Hawk Bluff, Nelson, Wisconsin, prepared by Tom Maechtle

1. Personnel at Hack Station.--Tom Maechtle, 711 Illinois Street, Geneva, Illinois 60134; Katherine Anne Dantzler, 1225 Rose Vista Court #8, St. Paul, Minnesota 55113.

2. Description of Site.--The hack site bluff is located 3.4 miles south of Nelson, Wisconsin. The hack box itself faced southwest, twenty feet below the top of the bluff. The talus below is comprised of thick woods containing red cedar, red oak, basswood and sugar maple. Below the slope the land has been cleared for pasture with clover predominant. Route 35 and the railroad tracks seperate the bluff from the shoreline.

Above the bluff are agricultural fields comprised of hay and corn, intersected by several wooded valleys.

3. History and Identification of Young Falcons.--Details are as follows:

Name & Sex	Federal Band/Leg	White Plastic Band	Hatch Date	Tail Streamer
Yellow M	576-89246 - L	Not applicable	4/29/77	Not applicable
Blue M	576-89247 - R	"	4/29/77	"
Red F	617-24738 - R	"	4/30/77	"

4. Pre-release Details.--Preparations for the falcons were begun in April. A pair of Great Horned Owls were located nesting in a large pothole near the base of the bluff. Mark Fuller conducted trapping attempts and removed the female and the one eyass from the nest. The male never returned to the eyrie as far as we could determine (the eyass was left tethered in the nest for several days in an attempt to trap the male on a noose carpet). Pigeons were tethered near the nest and several other areas in the hope that the male Great Horned Owl would reveal his presence. None of the pigeons were lost to any predator, and extensive hikes in the area failed to turn up any owls.

Three Swedish Goshawk traps were in constant use; none were successful.

On June 4th, the falcons were placed in the box, two males and one female. All ran behind the partition, occasionally vocalizing defensively. The falcons were fed six-week old chickens and Coturnix quail at 0900 and checked again at 1630 and if needed, more food was added. Peepholes installed previously enabled us to observe inside the box without disturbing the falcons. This helped to see whether food provided was adequate for their needs.

5. Fledging Details.--Nine days after the falcons were placed in the box the doors were opened. The previous evening transmitters were attached to the falcons. The two tiercels received yellow and blue transmitters, and the female's was red. After the doors were opened, the two males were out of the box. On June 14th, both males took their first flights in the morning. The female did not fledge until June 18th. All three birds made their flights without incident and immediately returned to the box.

6. Pursuit of Prey.--Blue was the first bird observed chasing prey. Three days after release he made an abrupt swerve at a swallow. On June 18th

Yellow chased a female wood duck. The duck was coming toward the cliff from the river when Yellow took chase. During the tail-chase Yellow tried to gain height on the duck in an attempt to stoop. The duck outflew the falcon to the safety of the woods. Two days later the same incident occurred although this time the duck seemed harder pressed to reach cover.

About this same time the tiercels were often seen diving at butterflies and moths as they flew around the hack area. Several were caught. While watching Yellow the morning of the 19th of June, I observed a classic flight of the peregrine. As he sat on a ledge near the hack box I noticed him bobbing as he looked below into the hay fields. Beneath him were several crows feeding in the fields. An instant later he dropped off the cliff and went into a power dive into the crows, but he did not strike one.

All hunting flights observed started at the hack box or the nearby ledges. Typical still hunting, followed by a flight to give chase was the most common pattern of hunting.

7. Identification of Prey Captured.--Various species of Butterflies and Moths throughout the observation period.

8. Roosting Behavior.--All three birds roosted in the hack box area, (either in the box or adjacent ledges), until the 17th when Blue roosted on ledges at the south end of the cliff. Blue was the first bird to disappear. He was never seen again after the 17th.

Yellow started using the same area to the south of the bluff on the 18th. Red started to roost with Yellow on the 22nd of June, she also was never seen alive again after the 22nd.

9. Assessment of Individual Birds.--Yellow was the first to fly, first observed chasing and catching butterflies, and most aggressive in mock attacks on his siblings. Blue was a close second on everything that Yellow did. These two males appeared to be more intelligent than the female Red. Red, when on the hack ledge could best be described as sluggish, at times clumsy. Although, when in the air none of these tendencies ever appeared.

10. Unusual Incidents.--The male known as Blue disappeared during the night of the 17th. There was a bad wind and rain storm that night, and we thought that he was blown off his roost and forced to fly during the night. His signal was working well up to this point and on the morning of the 18th we could no longer pick it up. The bluff slope was walked extensively, the cliff crevices and potholes were climbed, the railroad tracks were walked for several miles, and a car search with roof-mounted antenna was made throughout the area, but to no avail. That evening the car search was continued and the river bluffs were surveyed using telemetry for a one hundred mile radius. The following day a plane was hired, and the river was flown with telemetry aiding us on the 20th, again on the 21st and 22nd. The falcon's signal was never picked up.

Red then disappeared the night of the 22nd. Her signal continued to come in from the southeast side of the bluff, but farther back into the woods. In the early afternoon of the 23rd, Kathy and I split up and searched the slope of the valley next to the bluff. One half mile southeast of the hack cliff I found a nest built the previous year by a pair of Red-tailed Hawks with Red's signal coming in strongly. Under a nearby oak I found approxi-

mately twenty flight feathers from a peregrine. Kathy found me later and discovered a casting containing Blue's transmitter. Bones were not digested, suggesting an owl. The transmitter was corroded and non-functional. Red's signal was still coming in, but no other carcass could be found on the ground. She was finally found fifty feet up on an oak branch lying half-eaten.

The Red-tail nest had obviously been taken over by Great Horned Owls; we never knew it was there until it was too late. The surviving falcon was trapped and returned to Cornell.

11. General Evaluation and Other Comments.--This area of the Mississippi River has some of the finest peregrine cliffs east of the Rockies, including excellent habitat and availability of prey species. The Wisconsin DNR, and the Federal agents were very co-operative and interested. Public sentiment was pro-peregrine. Everything is perfect; however, Great Horned Owls are much too dense to fledge falcons successfully using present predator control methods.

I feel we need to learn more about the habits of Great Horned Owls; how to successfully remove them from an area, and then fledge peregrines before the owls are replaced by fringe area residents. In order to see whether this is feasible a study on removing Great Horned Owls and their nests early in the year could be made in a block area; later we could make a census to see how soon they are replaced. There are too many conflicting opinions held by raptor experts as to what happens when Great Horned Owls are removed from an area. We should do the study ourselves to find out for sure.

Another study that I feel would be helpful would be to trap and place transmitters on several pairs of owls and determine the range of their territories. I feel that if it had not been for the owls we would have successfully fledged all our birds.